

Insect and disease response to prescribed burning and wildfire in red pine in the Upper Peninsula of Michigan FHM: EM Project 05-CA-153



Rita M. Koch¹, Linda M. Haugen², Linda M. Nagel¹, Michael E. Ostry² and Andrew J. Storer¹

¹School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI; ²USDA Forest Service, St. Paul, MN



This study is being conducted in two fire sites in Luce County in the Upper Peninsula of Michigan. The first is the Muskrat Lakes Fire/Fire Surrogate Prescribed Burn Site, and the other is the Sleeper Lake Wildfire (Figure 1).

MUSKRAT LAKES FIRE/FIRE SURROGATE SITE



Figure 2: Prescribed burn in a mechanically treated site, Muskrat Lakes

Photo: Michigan DNR

Burn Objectives

Characterize the effects of prescribed fire and harvesting (thinning) treatments in natural red pine dominated forests on:

- Red turpentine beetle (*Dendroctonus valens*) activity
- Shoot blight pathogens
- Red pine regeneration

Site Characteristics:

Originated from a stand-replacing fire about 80 years ago. Pretreatment forest composition was 54% red pine, 16% white pine, 11% jack pine and 9% red oak. Mean DBH of red pine was 29 cm and mean height was 15 m.

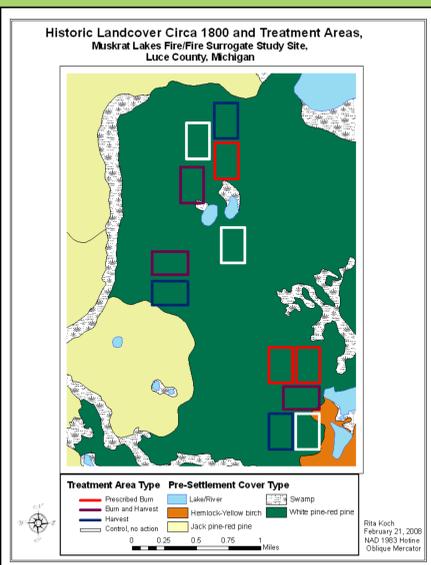
Study design Illustrated in Figure 3 (Modified from the National Fire/Fire Surrogate study www.fs.fed.us/ffs)

12 treatment areas of 17 hectares were divided into 4 treatment types:

- Untreated control
- Prescribed fire only
- Mechanical treatment only
- Mechanical treatment followed by prescribed fire

Each treatment area contains a grid of 20 plot centers 50 meters apart. Stand data were taken within a 0.04 hectare area around the plot center.

Figure 3 (below): Treatment area design and historic landcover



Rita Koch, February 21, 2009
NAD 1983 Hutter Oblique Mercator

MUSKRAT LAKES RESULTS

Entomology: Response of Red Turpentine Beetle (*Dendroctonus valens*):

- Attacks by red turpentine beetle on standing trees were higher in treatments that included fire (Fig. 5, Fig. 6 and Fig. 7)
- Attacks on stumps occur independently of fire (Fig. 8)
- No red turpentine beetle signs were observed in control treatments in 2006-2007 with one observation in 2008 (Fig. 5, Fig. 6 and Figure 7)



Photo by Rita Koch

Figure 4: *D. valens* and pitch tube

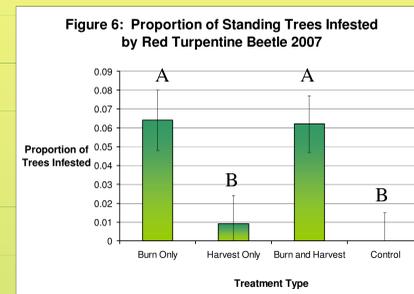
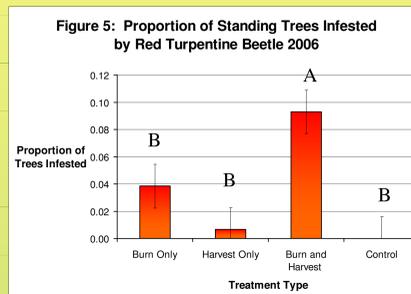


Figure 5 and 6: Least significant difference test after ANOVA of arcsine transformed data

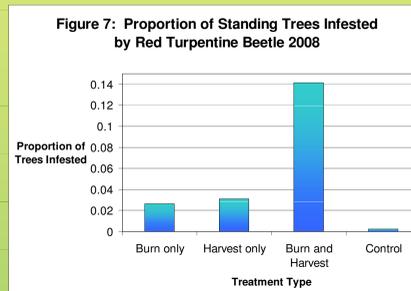


Figure 7: Initial untransformed proportion data

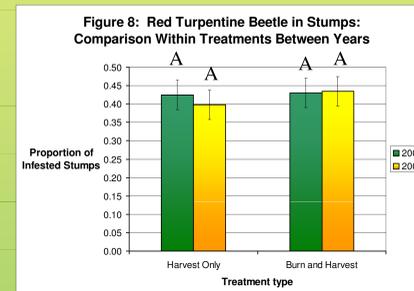


Figure 8: Analysis of variance of arcsine transformed data

Pathology: *Sirococcus* Shoot Blight

Spore traps were placed in each of the 12 treatment areas with 4 slides at each treatment area and 48 slides over the entire site. Slides were exposed for 14 days.

In 2006, *Sirococcus* spore counts were significantly lower in burned treatment areas than harvest only and control. *Sirococcus* spore counts were also significantly lower in harvest treatments than control (Fig. 10).

A similar procedure was repeated in 2009 in both the Muskrat Lakes and Sleeper Lake sites. These traps are currently being analyzed.

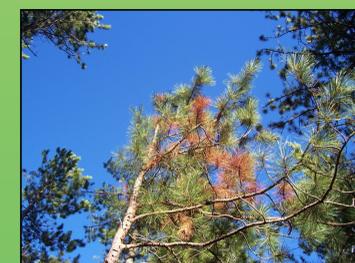
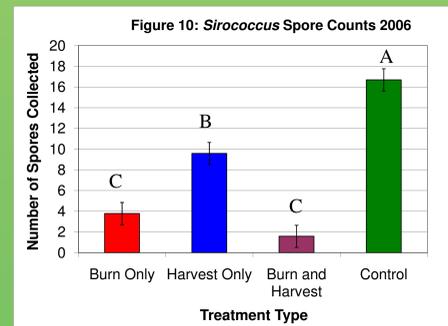


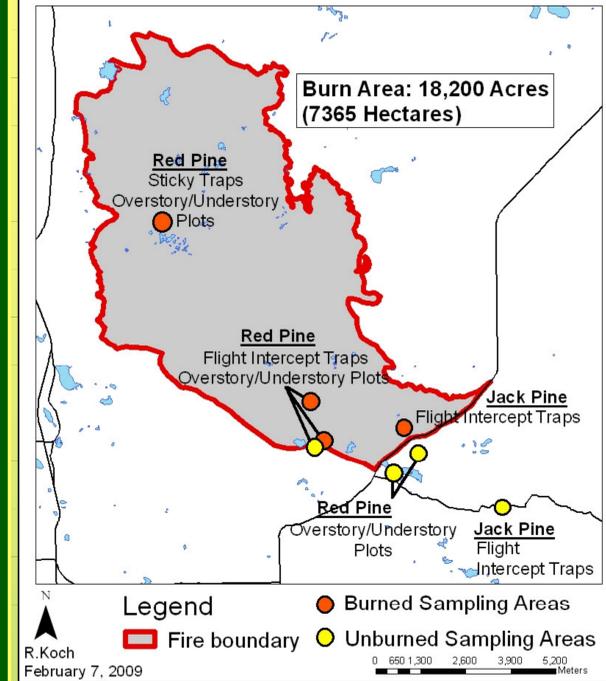
Photo by Rita Koch

Figure 9: Orange shoots symptomatic of shoot blight



SLEEPER LAKE WILDFIRE

Plot and Trap Locations, Michigan Tech Sleeper Lake Study, Summer 2008



Legend
 Burned Sampling Areas
 Unburned Sampling Areas
 Fire boundary
 R. Koch February 7, 2009
 0 650 1,300 2,600 3,900 5,200 Meters



Photos by Rita Koch

Figure 11 (left): Sleeper Lake sampling design
 Figure 12 (top): Flight intercept trap baited with ethanol/alpha-pinene
 Figure 13 (above): Hardware cloth sticky trap

Current Data Collection

In the summer of 2007, lightning ignited a wildfire that burned 7,365 hectares (18,200 acres) in Luce County. This burn is 10 miles from the Muskrat Lakes site and provides an exciting opportunity to conduct similar research on a wildfire. Additional sampling plots were added in 2009 in a recently discovered area of crown fire in red pine.

Recent data collection includes:

- Overstory tree data
- Understory herbaceous vegetation data
- Flight intercept trapping for wood-infesting beetles and woodwasps
- Sticky trapping on high and low scorched red pine to measure landing behavior
- Fire intensity and severity
- *D. valens* and pine engraver beetle (*Ips pini*) activity
- Tree growth response to Muskrat Lakes treatments with tree cores
- Age structure of Muskrat Lakes site with tree cores



Figure 14 (top): Sleeper Lake Wildfire (Photo: Michigan DNR)
 Figure 15 (above): Tree cores from Muskrat Lakes (Photo: Rita Koch)

Acknowledgements Funding: USDA Forest Service, Forest Health Monitoring; Evaluation Monitoring Project 05-CA-153 and the Ecosystem Science Center. Collaborators include: Les Homan, MI DNR, and Al Saberniak, USDA FS. Thank you also to Mike Hyslop, Tim Gebuhr, Pete Holodnick, Brian Henry, Holly Martin, Emily Grosvenor, Eric Van Wormer, Justin Rosemier, Janet Oisten, Molly Cypher, Jennifer Hamilton, Bryan Roosen, Nicole Ricci, Anthony Landon, Brian Southerland, Katie Hietala, Melissa Porter, Hannah Abbotts, Titus Brown and Wilf Previant.